Precision Optocoupler (v2.0)

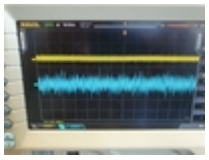
Function

An optocoupler is used to isolate a voltage source from the process (or experiment) by creating a optical link between the two using an LED-photodiode combination. A digital optocoupler can output only digital signals (high or low), while an analog optocoupler faithfully reproduces the input voltage into the same output voltage but now produced by an independent power source. This device provides good electrical isolation of the power source (typically, an analog output card of a computer) from potentially harmful processes that might occur on the experiment side (eg: voltage spikes during fast switching of magnetic fields).

The circuit and the board is a replica of a project by Todd Meyrath which can be found here. The central optocoupler circuit was inspired by fig. 17 of the datasheet of the HCNR200.

The original project required two independent +/- power supplies. This revamped version (2024) can be powered from a single +/- power supply by utilizing an isolated DC-DC converter (plus sophisticated filtering) to power the secondary side. If signal quality is absolutely important and any kind of residual noise introduced by the DC-DC converter (<1 mV) one can power the device as before from two independent (linear) +/- power supplies.

Properties



- Mechanical compatible with standard 160x100mm EuroCard slot (can be powered by backplane)
- Bandwidth is roughly 200-250 kHz (step-response: 4 µs delay)
- RMS ripple on the output should be around 2-3 mV

Date

Project date (v2.0): July 2024

About 10 almost fully populated boards have been ordered by VLBAI of which ~3-4 will be used.

Responsible

Klaus Zipfel (VLBAI)

Circuit diagram

The project is developed and managed by VLBAI at the VLBAI gitlab instance. Access can be granted by VLBAI members, if you need to develop on the project. A mirror is available IQ Gitea

- The schematic in PDF-Format
- The production files (gerber, cpl, bom)
- The Layout in HTML format (ibom)

Test

Input and output signals should ideally match 100% (offset and amplitude). If not, adjust via the three trimmers until they match.

Then apply a step-function (e.g. 1V, 50% duty at 1 kHz) to the input and observe the output. If you see oscillations/harsh transients, you might have not populated capacitor C11, C14 (missed out by first JLCPCB batch → Place 4.7 pF).

Kalkulation

was	wieviel	E-Preis	Preis	Anmerkung
Leiterplatte	10x	4€	40 €	JLCPCB
Bestückung	10x	2.5 €	25 €	JLCPCB
Versandt			75 €	Express + Customs done by JLCPCB
		Summe	150 €	10 boards → 15 € per board

Additional components required per board (not populated by JLCPCB)

was	wieviel	E-Preis	Preis	Anmerkung
isolated BNC	2x	1.5 €	3 €	Use from KMK
REF03	2x	4.35 €	8.7 €	Can be REF02 of KMK
BUF634	1x	3.42 €	3.42 €	Use from KMK
HCNR201	1x	7.28 €	7.28 €	Use from KMK (HCNR200)
L7912 (TO-263-3)	2x	1 €	2 €	
L7812 (TO-263-3)	2x	1 €	2 €	
DCWN06A-15	1x	12.31 €	12.31 €	Alternative isolated DC-DC converters that output +/-15 V can be used: Using industry standard footprint

Date Project date: August 2011

Responsible Hrishikesh Kelkar, kelkar@iqo.uni-hannover.de

Circuit diagram

- The schematic in PDF-Format
- The Eagle source files can be obtained from the Download-page of wiki. (Direkt-Link: Schematic, Board)

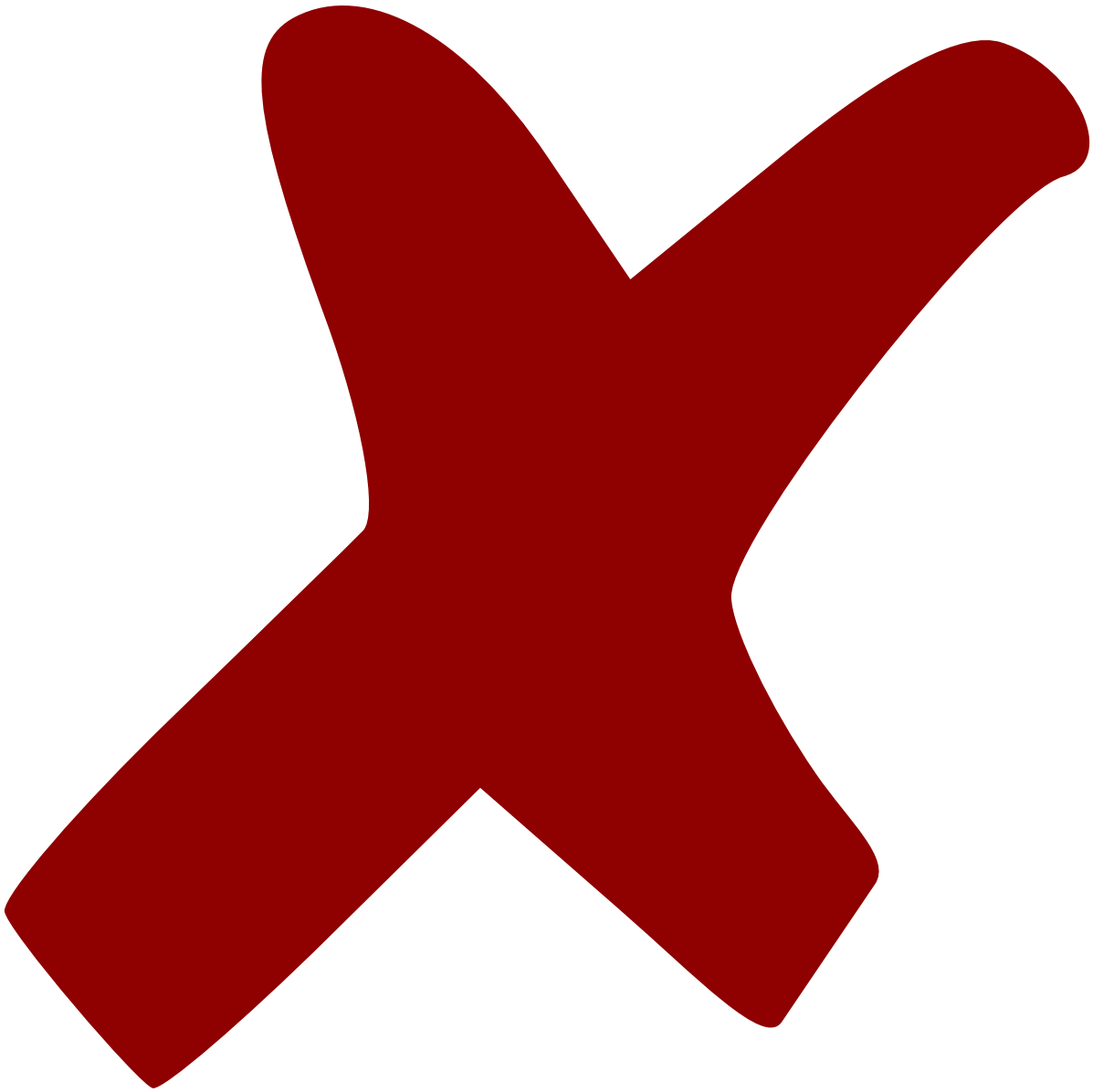
Test Eingangssignale sollten sich eins-zu eins am Ausgang wieder finden. Bandbreite ist etwa 10 kHz.

Kalkulation Fix Me!

was	wieviel	E-Preis	Preis	Anmerkung
Leiterplatte	1x	??.?? €	??.?? €	1/n von XXX EUR
Gehäuse	1x	??.?? €	??.?? €	
*	?x	??.?? €	??.?? €	...
R,C	??x	0.02 €	0.22 €	Bauform 0805
Bestückung			??.00 €	bei SRM
Verschnitt			?.?? €	
		Summe	??.?? €	

Meckerliste

Was für die nächste Version zu tun ist: (



: verworfen,

: in Arbeit,

: im Schaltplan, aber noch nicht im Layout,

: erledigt)

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